



PATENT
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

PARK et al.

Application No. 09/839,594

Art Unit: 2823

Filed: April 23, 2001

Examiner: K. Nguyen

For: LOW DIELECTRIC COMPOSITE WITH
NANO MAGNETIC PARTICLES,
MANUFACTURING METHOD
THEREOF, AND SEMICONDUCTOR
DEVICE AND OPTICAL DEVICE
USING THE SAME

**PENDING CLAIMS AFTER AMENDMENTS
MADE IN RESPONSE TO OFFICE ACTION DATED OCTOBER 24, 2002**

1. A composite comprising:
a layer of a dielectric material having a thickness, as a matrix of the composite; and
nano magnetic particles having a dimension and dispersed throughout the matrix,
wherein the thickness is at least one thousand times the dimension.
2. The composite according to claim 1, wherein the nano magnetic particles are non-spherical.
3. The composite according to claim 2, including spherical nano magnetic particles in addition to the non-spherical nano magnetic particles.
4. The composite according to claim 1, wherein the nano magnetic particles are spherical.
5. The composite according to claim 1, wherein the matrix is selected from the group consisting of silica, alumina, and hydrosilsesquioxane.
6. The composite according to claim 1, wherein the matrix is selected from the group consisting of polyimide, polymethyl methacrylate, and methyl silsesquioxane.

7. The composite according to claim 1, wherein the nano magnetic particles are superparamagnetic.

8. The composite according to claim 7, including diamagnetic nano magnetic particles in addition to the superparamagnetic nano particles.

9. The composite according to claim 8, wherein the diamagnetic nano particles include indium.

10. The composite according to claim 1, wherein the nano magnetic particles are diamagnetic.

11. The composite according to claim 1, wherein the nano magnetic particles are selected from the group consisting of γ -Fe₂O₃, chromium oxide, europium oxide, NiZn-ferrite, MnZn-ferrite, and yttrium-iron garnet.

12. The composite according to claim 2, wherein the nano magnetic particles include indium.

13. A semiconductor device comprising:
a semiconductor substrate; and
an insulator disposed on the semiconductor substrate and comprising a composite including a layer of a dielectric material having a thickness, as a matrix of the insulator, and nano magnetic particles having a dimension and dispersed throughout the matrix, wherein the thickness is at least one thousand times the dimension.

14. The semiconductor device according to claim 13, wherein the nano magnetic particles are non-spherical.

15. The semiconductor device according to claim 13, wherein the nano magnetic particles are spherical.

16. The semiconductor device according to claim 13, wherein the nano magnetic particles are superparamagnetic.

17. The semiconductor device according to claim 15, wherein diamagnetic nano magnetic particles are added to the superparamagnetic nano particles.

18. An optical device comprising:
a layer of a transparent dielectric material having a thickness, as a matrix; and
nano magnetic particles dispersed within the matrix, wherein the thickness is at least one thousand times the dimension.

19. The optical device according to claim 18, wherein the nano magnetic particles are non-spherical.

20. The optical device according to claim 18, wherein the nano magnetic particles are spherical.